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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modulation of radiative aerosols effects by atmospheric circulation over the Euro-Mediterranean region" *by* Pierre Nabat et al.

Anonymous Referee #2

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Nabat et al. present firstly a new model version of a regional climate model that has a number of revised parameterisations compared to a previous version. An evaluation with multiple observational datasets is presented. This evaluation is a bit hampered by the fact that no direct comparison is presented between the new model version and an older one, even if often the text compares the skill of the previous version (unknown to the reader unless they carefully studied the former papers by the authors). In particular the aerosol distributions and temporal variability are compared to satellite retrievals and surface remote sensing. The models shows a rather remarkable skill both for the geographical distribution and the annual cycles of aerosol optical depths. The bulk of the manuscript is a lengthy analysis on how aerosols are simulated differently

for different weather conditions as firstly defined by the NAO index (presumably as seasonal averages, the text needs to be clarified on the temporal resolution of the analysis), and secondly defined by four clusters in terms of sea-level pressure.

The study is in general well written, remaining issues will be corrected in the copy-editing process.

It is of interest to the readership of Atmos. Chem. Phys.

However, I suggest that the authors consider to re-work their study somewhat before it should be accepted for Atmos. Chem. Phys.

(1) The second part of the study, in particular where analysing aerosol effects by weather regime, makes use of the integration without aerosol effects. This is a weak point of the analysis since the reader does not know much about this second integration. Firstly it is necessary to clearly define the differences between the simulations with and without aerosols. Is this really the same model, except that in one the aerosol sources are zero? Or is the model different? Secondly it would be very useful to know whether the two model variants behave comparatively well. The authors could evaluate both model variants in the first part of their study. It would be necessary also that the mean differences in terms of surface radiation and surface temperature are presented. It would be useful to show the geographical patterns of temporal trends of the differences aerosol minus no-aerosol in these two quantities.

(2) The description of the aerosol as a function of weather regime is too long. The authors should consider dropping (or moving to an appendix or supplementary material) many of the plots that are only very superficially discussed and do not help very much the understanding. The conclusions can easily be drawn without this lengthy detail.

Specific comments

p2l25 – MODIS acronym not introduced yet

p3l8 – why "seems to be" only?

p3l14 – Virtually all studies consider of course the interactions (implicitly in interactive simulations and in observational analysis), but do not investigate or analyze these in detail.

p3l16 – probably “analyzing” rather than “establishing” is more what it is

p4l10 – the URL seems to be erroneous

p4l29 – ‘subject’ rather than ‘submitted’

p4l30 – soil only in case of dust presumably

p5l3 – limits in radius or diameter?

p6l32 – MISR data product reference is missing

p7l20 – within → from

p8l20 – is this really a capacity, or wouldn’t it rather be very surprising if the regional model deviated a lot from the driving one?p9l1 – correct reference

p9l3 – 0.6 mm day-1 bias translate to a very substantial energy budget problem (of 18 Wm-2 if I’m not mistaken). Is this really acceptable? Where does it come from?

p9l6 – “improved” compared to which reference?

p9l13 – why “also” underestimated? And is it not surprising that a warm bias goes along with a dry bias?

p11l26 – it seems impossible to attribute the biases to specific types

p20l14 – correct section reference

p33/Table 3 – “temperature”; what are the two numbers for ECx?

p34/Table 4 – clarify whether this is for seasonal-mean AOD / NAO index

p37/Fig. 3 – were satellite simulators such as the COSP simulator used for a fair

comparison between the Cloudsat/Calipso and simulated cloud fractions?

p40/Fig. 6 – why is the aerosol concentration not reduced at the domain borders where the boundary condition sets the aerosol to zero?

p43 – is that for seasonal means?

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